The water seal is generally used, the steam being for manoeuvring, starting, and stopping. The glands can be opened for inspection without disturbing any other part of the cylinder. Automatic overspeed devices to prevent the turbine running away are fitted to high- and low-pressure units. Relief valves are provided on high- and low-pressure cylinders to relieve excessive steam pressure in case of the breakdown of condenser auxiliaries.

Special straddle gauges are provided by means of which wear on the bearings can be readily ascertained at any time.

The turbine and gears are lubricated by a combined pressure and gravity system.

Turbo-electric Schemes.—Whilst the development of large-power gearing has gone a long way towards solving one of the main inherent problems of the application of the steam turbine to ship propulsion, the use of separate reversing turbines must still be considered a drawback. The extra capital cost which they entail is a matter of comparatively small moment. The fact that the astern turbine, has to run idle when not in use entails a permanent windage loss with appreciable effect on the ship's coal consumption. Ordinary working conditions involve the necessity of the astern turbine being put on maximum load at short notice, and this condition implies a severe sudden change of blade temperature. The range of temperature which blading material can be safely subjected to under such conditions is limited, and these considerations have impeded, the use of highly superheated steam on board ship, and have deprived marine turbine makers of the opportunity of availing themselves of most favourable steam economy, such as is available for land work.

If the nlechanical gearing is replaced by electric reduction gearing, that is to say, if the turbine drives a generator supplying current to motors which usually drive the propellors through mechanical reduction gearing, then the reversing operation can be carried out easily on the motors without affecting the direction of rotation of the turbine.

This question of turbine propulsion of steamships with the interposition of electric generators and motors as gearing was seriously

considered some thirteen years ago by the General Electric Company in America, and they found in the United States Navy Bureau of Steam Engineering an organization progressive enough to take up and try the system.

The first ship engined on this plan was the collier *Jupiter.* Up to 1919 this boat had been in commission over five years, and had been in service practically continuously without electrical trouble, thus demonstrating the reliability of the system.

The 1916 United States Navy Bill authorized four battle-cruisers and several battleships, all with turbo-electric drive. The battle-cruisers each had turbines of 180,000 h.p., and were to steam at 35 knots. The battleships required 33,000 h.p. each.

In 1919 the *New Mexico,* United States capital ship, one of the battleships, successfully completed her trials.